KROHNE

Operating Instructions

OPTISWITCH 3000 C
with relay output

- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- Electromagnetic flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- **Level measuring instruments**
- Communications engineering
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

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Supplementary operating instructions manuals

Information:
OPTISWITCH 3000 C is available in different versions. Depending on the selected version, supplementary operating instructions manuals will also be included in the delivery. The supplementary operating instructions manuals are listed in section "*Product description*".

Operating instructions manuals for accessories and replacement parts

Tip:
To ensure reliable use and operation of your OPTISWITCH 3000 C we offer accessories and replacement parts. The corresponding operating instructions manuals are:

- Operating instructions manual "*Oscillator*"

1 About this document

1.1 Function

This operating instructions manual has all the information you need for quick setup and safe operation. Please read this manual before you start setup.

1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution, warning, danger
This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.

Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence**
Numbers set in front indicate successive steps in a procedure.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained, specialist personnel authorised by the operator. For safety and warranty reasons, any internal work on the instruments must be carried out only by personnel authorised by the manufacturer.

2.2 Appropriate use

OPTISWITCH 3000 C is a sensor for level detection.

Detailed information on the application range of OPTISWITCH 3000 C is available in chapter "*Product description*".

2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

OPTISWITCH 3000 C is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

2.5 CE conformity

OPTISWITCH 3000 C is in CE conformity with EMC (89/336/EWG), fulfils the NAMUR recommendation NE 21 and is in CE conformity with NSR (73/23/EWG).

Conformity has been judged acc. to the following standards:

- EMC:
  - Emission EN 61326: 1997 (class B)
  - Susceptibility EN 61326: 1997/A1: 1998
- LVD: EN 61010-1: 2001

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- OPTISWITCH 3000 C level sensor
- Documentation
  - this operating instructions manual
  - Supplementary instructions manual *"Plug connector for level sensors"* - optional

Components

OPTISWITCH 3000 C consists of the following components:

- Housing cover
- Housing with electronics
- process fitting with tuning fork

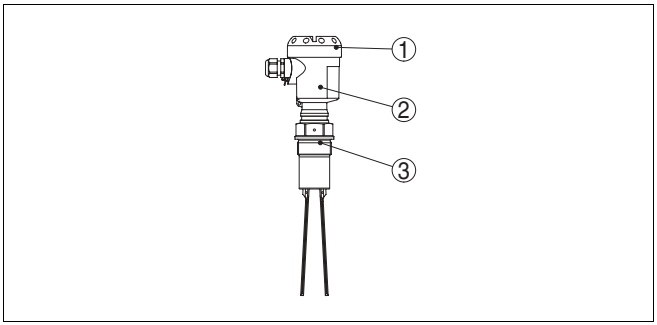

Fig. 1: OPTISWITCH 3000 C - with plastic housing
1 Housing cover
2 Housing with electronics
3 Process fitting

3.2 Principle of operation

Area of application

OPTISWITCH 3000 C is a level sensor with tuning fork for level detection.

It is designed for industrial use in all areas of process technology and is preferably used for bulk solids.

Typical applications are overfill and dry run protection. Thanks to its simple and robust measuring system, OPTISWITCH 3000 C is virtually unaffected by the chemical and physical properties of the solid.

It functions even when exposed to strong external vibration or changing products.

Fault monitoring
The electronics of OPTISWITCH 3000 C continuously monitors the following criteria:

- Correct vibrating frequency
- Line break to the piezo drive

If one of these faults is detected or in case the power supply fails, the electronics takes on a defined switching condition, i.e. the relay deenergizes (safe condition).

Physical principle

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 150 Hz. When the tuning fork is submerged in the product, the vibration amplitude changes. This change is detected by the integrated oscillator and converted into a switching command.

Power supply

OPTISWITCH 3000 C is a compact instrument, i.e. it can be operated without external evaluation system. The integrated electronics evaluates the level signal and outputs a switching signal. With this switching signal, a connected device can be operated directly (e.g. a warning system, a PLC, a pump etc.).

The exact range of the voltage supply is specified in the "*Technical data*" in the "*Supplement*".

3.3 Adjustment

OPTISWITCH 3000 C can detect products with a density >0.08 g/cm^3 (>0.003 lbs/in^3).

On the electronics module you will find the following indicating and adjustment elements:

- signal lamp for indication of the switching condition (green/red)
- mode switch for selection of the output current

3.4 Storage and transport

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test acc. to DIN 55439.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. In addition, the sensor is provided with a protective cover of cardboard. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Storage and transport temperature

- Storage and transport temperature see "Supplement - Technical data - Ambient conditions"
- Relative humidity 20 ... 85 %

4 Mounting

4.1 General instructions

Switching point

In general, OPTISWITCH 3000 C can be mounted in any position. The instrument must be mounted in such a way that the vibrating element is at the height of the requested switching point.

Moisture

Use the recommended cable (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your OPTISWITCH 3000 C additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to mounting outdoors, in areas where moisture is expected (e.g. by cleaning processes) or on cooled or heated vessels.

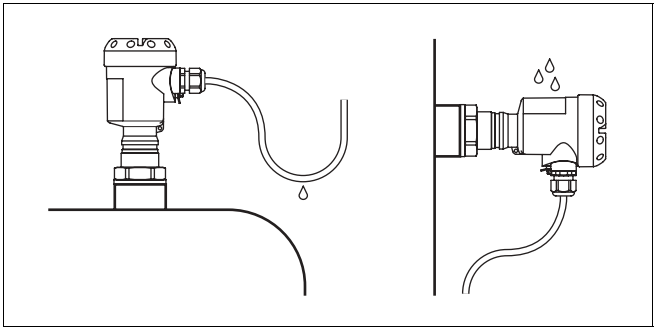

Fig. 2: Measures against moisture penetration

Transport

Do not hold OPTISWITCH 3000 C on the vibrating element. The sensor can be damaged by the weight of the instrument.

Remove the protective cover just before mounting.

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the seal material is resistant against the measured product and the process temperature.

Handling

The vibrating level switch is a measuring instrument and must be treated accordingly. Bending the vibrating element will destroy the instrument.

Warning:
The housing must not be used to screw the instrument in! Applying tightening force on the housing can damage its internal mechanical parts.

To screw in, use the hexagon above the thread.

4.2 Mounting information

Socket

The vibrating element should protrude into the vessel to avoid buildup. For that reason, avoid using mounting bosses for flanges and screwed fittings. This applies particularly to use with adhesive products.

Filling opening

Install the instrument in such a way that the tuning fork does not protrude directly into the filling stream. Should such an installation location be necessary, mount a suitable baffle above or in front of the tuning fork.

If such an installation location should be necessary, mount a suitable protective sheet above or in front of the vibrating element - see illustration a.).

In abrasive solids, mounting acc. to illustration b. has proven. A spout forms in the concave protective sheet preventing wear of the protective sheet.

Horizontal installation

To achieve a very precise switching point, you can install OPTISWITCH 3000 C horizontally. However, if the switching point can have a tolerance of a few centimeters, we recommend mounting OPTISWITCH 3000 C approx. 20° inclined to the vessel bottom to avoid buildup.

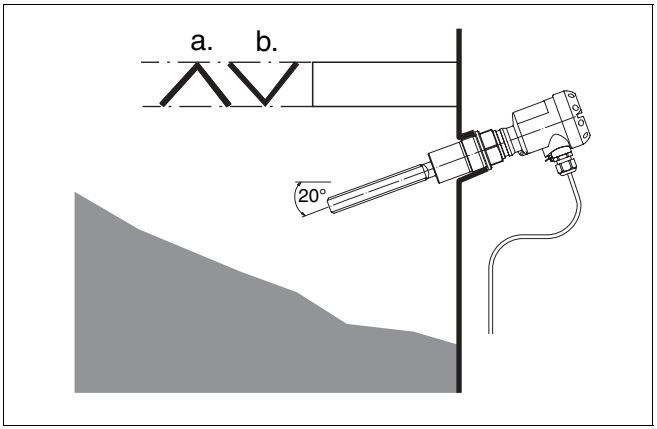

Fig. 3: Horizontal installation
a Protective sheet
b Concave protective sheet for abrasive solids

Inflowing material

If OPTISWITCH 3000 C is mounted in the filling stream, unwanted switching signals can be generated. Mount OPTISWITCH 3000 C at a location in the vessel where no disturbing influence from e.g. filling openings, agitators, etc. can occur.

Flow

To minimise flow resistance caused by the tuning fork, OPTISWITCH 3000 C should be mounted in such a way that the surfaces of the fork are parallel to the product movement.

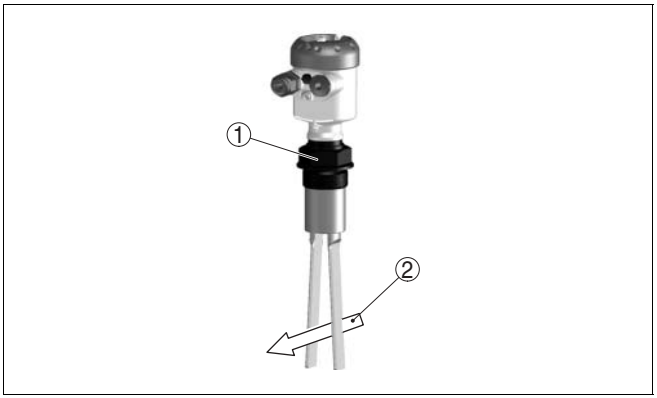

Fig. 4: Orientation of the tuning fork in case of flow
1 Marking with screwed version
2 Direction of flow

Adhesive products

In case of horizontal mounting in adhesive products, the surfaces of the tuning fork should be vertical in order to reduce buildup on the tuning fork. On the screwed version you will find a marking on the hexagon. With this, you can check the position of the tuning fork when screwing it in. When the hexagon touches the seal, the thread can be still turned by approx. half a turn. This is sufficient to reach the recommended installation position.

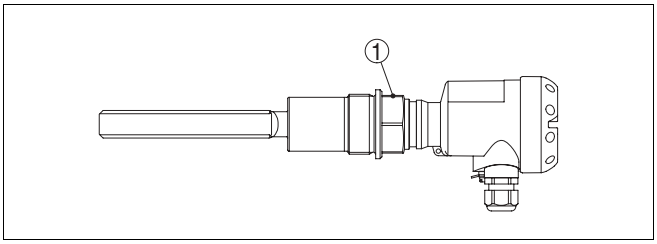

Fig. 5: Vertical installation - marking
1 Marking on top with screwed version

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always observe the following safety instructions:

- Connect only in the complete absence of line voltage

Select power supply

Connect the power supply acc. to the following diagrams. Oscillator VB 60R is designed in protection class 1. To maintain this protection class, it is absolutely necessary that the ground conductor be connected to the internal ground terminal. Take note of the general installation regulations. As a rule, connect OPTISWITCH 3000 C to vessel ground (PA), or in case of plastic vessels, to the next ground potential. On the side of the instrument housing there is a ground terminal between the cable entries. This connection serves to drain off electrostatic charges.

The data for power supply are stated in the Technical data in the Supplement.

Select connection cable

OPTISWITCH 3000 C is connected with standard cable with round cross-section. An outer cable diameter of 5 ... 9 mm (0.2 ... 0.35 in) ensures the seal effect of the cable entry.

If cable with a different diameter or wire cross section is used, exchange the seal or use an appropriate cable connection.

5.2 Connection procedure

Proceed as follows:

1 Unscrew the housing cover

2 Loosen compression nut of the cable entry

3 Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires

4 Insert the cable into the sensor through the cable entry

5 Lift the opening levers of the terminals with a screwdriver (see following illustration)

6 Insert the wire ends into the open terminals according to the wiring plan

7 Press down the opening levers of the terminals, you will hear the terminal spring closing

8 Check the hold of the wires in the terminals by lightly pulling on them

9 Tighten the compression nut of the cable entry, the seal ring must completely encircle the cable

10 Screw the housing cover back on

The electrical connection is finished.

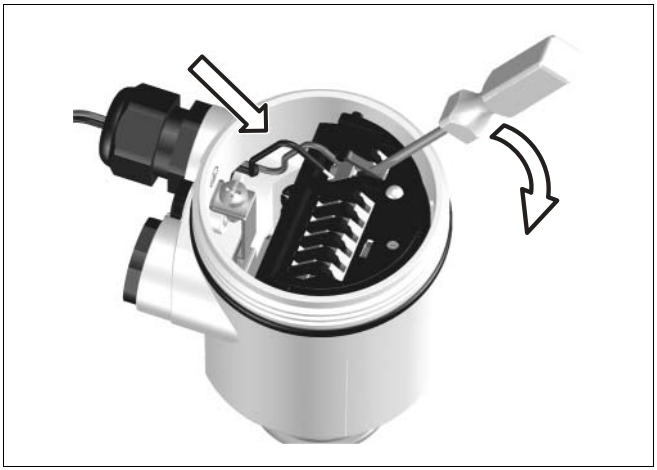

Fig. 6: Connection steps 5 and 6

5.3 Wiring plans, signal chamber housing

Electronics and connection compartment

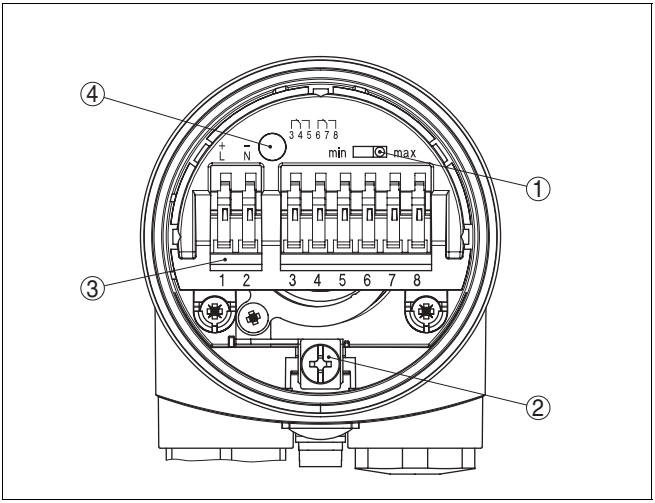

Fig. 7: Electronics and connection compartment
1 DIL switch for mode adjustment
2 Ground terminal
3 Terminals
4 Control lamp

Wiring plan

We recommend connecting OPTISWITCH 3000 C in such a way that the switching circuit is open when there is a level signal, line break or failure (safe condition).

The relays are always shown in non-operative condition.

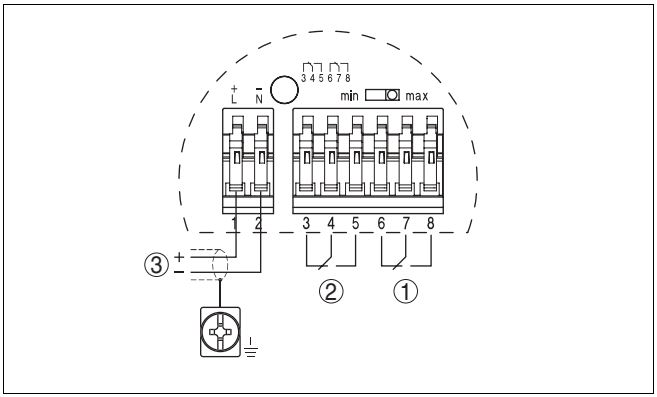

Fig. 8: Wiring plan
1 Relay output
2 Relay output
3 Voltage supply

6 Setup

6.1 General

The numbers in brackets refer to the following illustrations.

Function/Configuration

On the electronics module you will find the following indicating and adjustment elements:

- DIL switch for mode adjustment - min./max. (1)
- Signal lamp (4)

Note:
As a rule, always set the mode with the mode switch (1) before starting setup OPTISWITCH 3000 C. The switching output will change if you set the mode switch (1) afterwards. This could possibly trigger other connected instruments or devices.

6.2 Adjustment elements

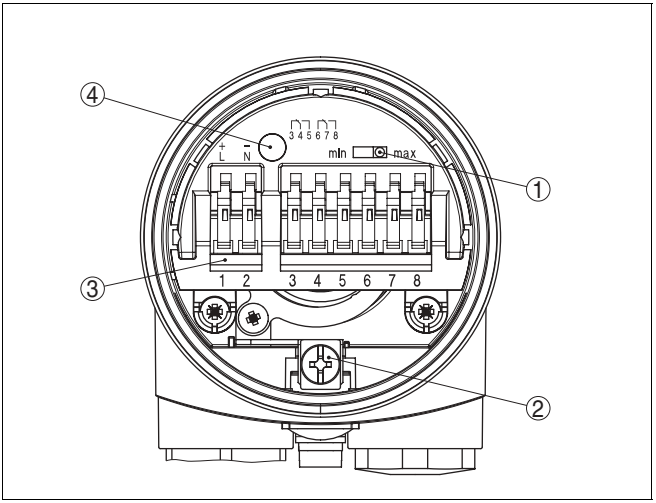

Fig. 9: Oscillator - Relay output
1 DIL switch for mode adjustment
2 Ground terminal
3 Terminals
4 Control lamp

Mode adjustment (1)

With the mode adjustment (min./max.) you can change the switching condition of the relay. You can set the required mode

acc. to the "*Function chart*" (max. - max. detection or overfill protection, min. - min. detection or dry run protection).

We recommend connecting acc. to the quiescent current principle (replay contact deenergizes when reaching the switching point), because the relay takes on the same (safe) condition if a failure is detected.

Signal lamp (4)

Control lamp for indication of the switching condition.

- green = relay energized
- red = relay deenergized
- red (flashing) = failure

6.3 Function chart

The following chart provides an overview of the switching conditions depending on the adjusted mode and level.

	Level	Switching status	Control lamp
max. mode Overfill protection		 Relay energized	 Green
max. mode Overfill protection		 Relay deenergized	 red
min. mode Dry run protection		 Relay energized	 Green
min. mode Dry run protection		 Relay deenergized	 red

	Level	Switching status	Control lamp
Failure of the supply voltage (min./max. mode)	any	 Relay deenergized	○
Failure	any	 Relay deenergized	 flashes red

7 Maintenance and fault rectification

7.1 Maintenance

When used as directed in normal operation, OPTISWITCH 3000 C is completely maintenance-free.

7.2 Fault rectification

Checking the switching signal

? OPTISWITCH 3000 C signals "covered" when the vibrating element is not submerged (overfill protection)

? OPTISWITCH 3000 C signals "uncovered" when the vibrating element is submerged (dry run protection)

- Supply voltage too low

→ Check the power supply

- Electronics defective

→ Push the mode switch (min./max.). If the instrument then changes the mode, the instrument may be mechanically damaged. Should the switching function in the correct mode still be faulty, return the instrument for repair.

→ Push the mode switch. If the instrument then does not change the mode, the oscillator may be defective. Exchange the oscillator.

→ Check if there is buildup on the vibrating element, and if so, remove it.

- Unfavourable installation location

→ Mount the instrument at a location in the vessel where no dead zones or mounds can form.

→ Check if the vibrating element is covered by buildup on the socket.

- Wrong mode selected

→ Set the correct mode on the mode switch (max: overfill protection; min: dry run protection). Wiring should be carried out acc. to the quiescent current principle.

? Signal lamp flashes red

- Electronics has detected a failure

→ Exchange instrument or return it for repair

7.3 Exchanging the electronics

In general, all oscillators of series VB60 can be interchanged. If you want to use an oscillator with a different signal output, you can download the corresponding operating instructions manual from our homepage under Downloads.

Proceed as follows:

1 Switch off power supply

2 Unscrew the housing cover

3 Lift the opening levers of the terminals with a screwdriver

4 Pull the connection cables out of the terminals

5 Loosen the two screws with a Phillips screwdriver (size 1)

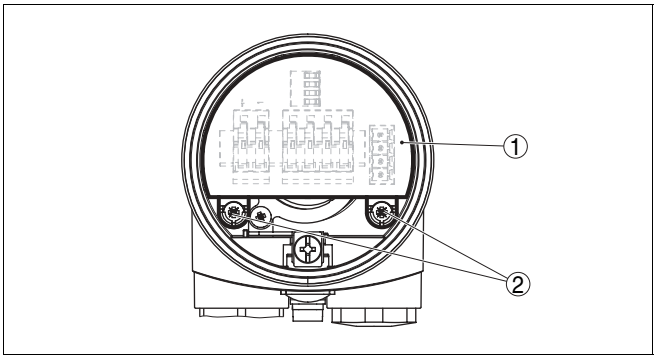

Fig. 10: Loosen the screws
1 Electronics module
2 Screws (2 pcs.)

6 Remove the old oscillator

7 Compare the new oscillator with the old one. The type label of the oscillator must correspond to that of the old oscillator.

8 Compare the settings of the two oscillators. Set the adjustment elements of the new oscillator to the settings of the old oscillator.

Information:
Make sure that the housing is not rotated during the electronics exchange. Otherwise the plug may be in a different position later.

9 Insert the oscillator carefully. Make sure that the plug is in the correct position.

10 Screw in and tighten the two screws with a Phillips screwdriver.

11 Insert the wire ends into the open terminals according to the wiring plan

12 Close the opening levers of the terminals, you will hear the terminal spring closing

13 Check the hold of the wires in the terminals by lightly pulling on them

14 Check the tightness of the cable entry. The seal ring must completely encircle the cable.

15 Screw the housing cover back on

The electronics exchange is finished.

7.4 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form from our Internet homepage http://www.krohne-mar.com/fileadmin/media-lounge/PDF-Download/Specimen_e.pdf.

By doing this you help us carry out the repair quickly and without having to call for additional information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument

8 Dismounting

8.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "Mounting" and "Connecting to power supply" and carry out the listed steps in reverse order.

8.2 Disposal

OPTISWITCH 3000 C consists of materials which can recycled by specialised recycling companies. We have purposely designed the electronic modules to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws (in Germany, e.g. ElektroG). Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may only be used for privately used products acc. to the WEEE directive.

Correct disposal avoids negative effects to persons and environment and ensures recycling of useful raw materials.

Materials: see "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

9 Supplement

9.1 Technical data

General data

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts	
– Process fitting - Thread	plastic PBT (Polyester)
– Process seal - Thread	Klingersil C-4400
– Tuning fork	316L
Materials, non-wetted parts	
– Housing	plastic PBT (Polyester)
– Seal ring between housing and housing cover	silicone
– Ground terminal	316L
Weight	1500 g (53 oz)
Max. lateral load	600 N (135 lbf) longitudinal to the fork side

Output variable

Output	relay output (DPDT), 2 floating spdts
Turn-on voltage	
– min.	10 mV
– max.	253 V AC, 253 V DC
Switching current	
– min.	10 µA
– max.	3 A AC, 1 A DC
Breaking capacity	
– min.	50 mW
– max.	750 VA AC, 54 W DC If inductive loads or stronger currents are switched through, the gold plating on the relay contact surface will be permanently damaged. The contact is then no longer suitable for switching low-level signal circuits.

Contact material (relay contacts)	AgNi or AgSnO and Au plated
Modes (adjustable)	min/max
Integration time	
– when immersed	approx. 0.5 s
– when laid bare	approx. 1 s

Ambient conditions

Ambient temperature on the housing	-40 … +80°C (-40 … +176°F)
Storage and transport temperature	-40 … +80°C (-40 … +176°F)

Process conditions

Parameter	level of solids
Process pressure	-1 … 6 bar (-100 … 600 kPa / -14.5 … 87 psi)
Process temperature	-50 … +100°C (-58 … +212°F)
Density	>0.08 g/cm^3 (>0.003 lbs/in^3)

Electromechanical data

Cable entry/plug (dependent on the version)	
– Single chamber housing	• 1x cable entry M20x1.5 (cable-ø5 … 9 mm), 1x blind stopper M20x1.5, attached 1x cable entry M20x1.5 or: • 1x cable entry ½ NPT, 1x blind stopper ½ NPT, 1x cable entry ½ NPT or: • 1x plug M12x1, 1x blind stopper M20x1.5
Spring-loaded terminals	for wire cross section up to 1.5 mm^2 (0.0023 in^2)

Adjustment elements

Mode switch	
– min.	min. detection or dry run protection
– max.	max. detection or overfill protection

Voltage supply

Power supply	20 … 253 V AC, 50/60 Hz, 20 … 72 V DC (with U >60 V DC the ambiet temperature can be max. +50°C/+122°F)
Power consumption	1 … 8 VA (AC), approx. 1.3 W (DC)

Electrical protective measures

Protection	IP 66/IP 67
Overvoltage category	III
Protection class	I

9.2 Dimensions

OPTISWITCH 3000 C[1)]

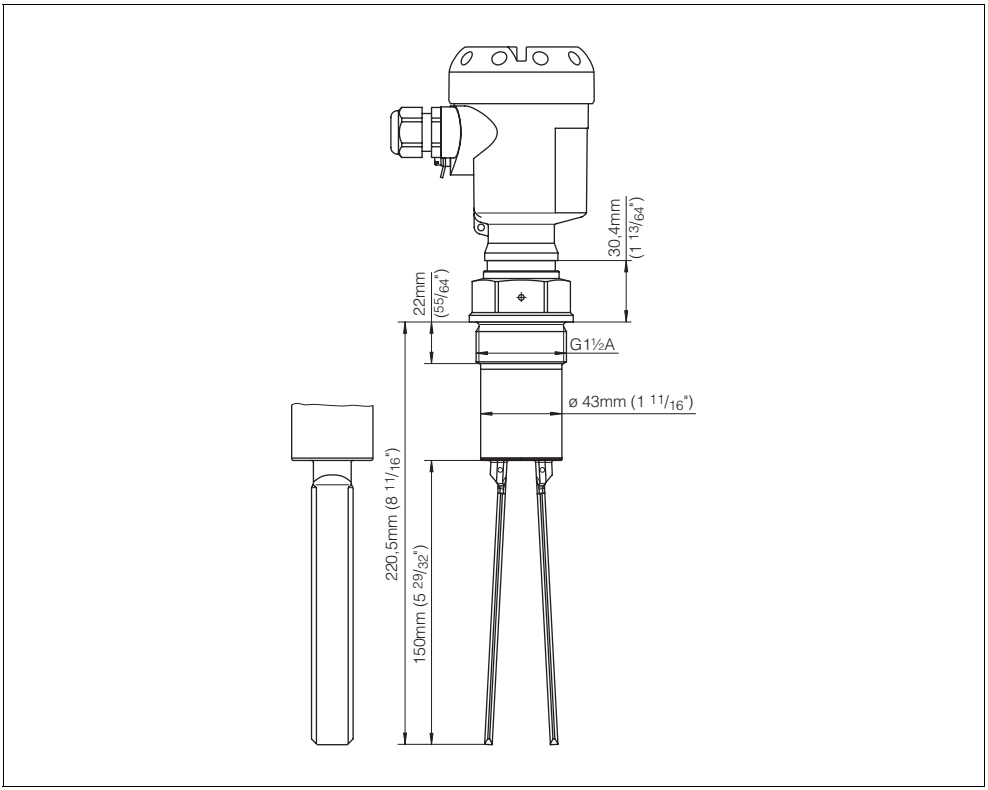

Fig. 11: OPTISWITCH 3000 C - Threaded version G1½A

[1)] All dimensions in mm (inch).

9.3 Certificates

CE declaration of conformity

CE

Konformitätserklärung

Declaration of conformity
Déclaration de conformité

KROHNE

Krohne S.A.S.
Les Ors BP 98
F-26103 Romans Cedex

erklärt in alleiniger Verantwortung, daß das Produkt / declare under our sole responsibility that our product / déclare sous sa seule responsabilité que le produit

OPTISWITCH 3000 C
mit Relaisausgang / with relay output / avec sortie relais (VB60R)
mit Transistorausgang / with transistor output / avec sortie transistor (VB60T)
mit Zweileiterausgang / with two-wire output / avec sortie bifilaire (VB60Z)

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt / to which this declaration relates is in conformity with the following standards / auquel se réfère cette déclaration est conforme aux normes

Emission / Emission / Emission → EN 61326 : 1997 (Klasse B)
Immission / Susceptibility / Immission → EN 61326 : 1997 / A1 : 1998
EN 61010 – 1 : 2001

gemäß den Bestimmungen der Richtlinien / following the provision of Directives / conformément aux dispositions des Directives

73/23 EWG
89/336 EWG

03.02.2005

i.V./p.p./P.O. Florian Stengele

Fig. 12: CE declaration of conformity

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Subject to change without notice